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Fiscal Decentralization and Soft Budget Constraints

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Liberalization policies of transition have led to the mass reduction of enterprise subsidization which prevailed in socialist economies. However, in some sectors of the economy, subsidies associated with price controls remain due to "social" and "political" factors. Moreover in multi-tier governments, subnational levels seem to be more sensitive to these factors because of their proximity to the constituency. Thus decentralization of fiscal resources might interfere with the elimination of residual subsidies. This research establishes a link between fiscal decentralization and the propensity of local governments to subsidize enterprises. The link is tested empirically on a panel of 72 Russian regions over the period 1995 – 1997.

Keywords: Russia, fiscal decentralization, local government, transition, subsidies, price control.

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NON-TECHNICAL SUMMARY

Transition from socialism to a free market economy has involved decentralization of both the economy and the government. Moreover, these two aspects seem to be highly interdependent so that a setback in either one can stall the whole process of reforms. A striking example of how decentralization of government can interfere with economic reforms is presented in the Russian experience of reducing budgetary subsidies to enterprises. Democratic elections at all levels of government replaced the communist party appointees with public officials accountable to the constituency. The newly empowered subnational leaders started to claim their share of what used to be a centralized pool of fiscal resources by capturing local offices of the revenue service. Trying to balance its fiscal accounts, the central government responded by "off-loading" expenditure responsibilities to the subnational level.

One of the expenditure items shifted down to subnational governments was budgetary subsidies that used to play a key role in bridging centrally set prices with enterprise specific costs. Liberalization policies during transition allowed prices to rise toward market clearing levels thus reducing the extent of subsidization. Yet, in some sectors subsidies associated with price-controls remained due to social and political factors. The central government discontinued providing subsidies from the federal budget while delegating the discretion to regulate prices to the subnational governments. Yet, due to their proximity to the constituency, subnational leaders appear to be more sensitive to the political factors of subsidization. Thus, they were quick to fill in the gap left by the central government. Hence, the central government solved its short-run fiscal imbalance at the expense of losing control of further price liberalization.

There are no counterfactual data to test the hypothesis that elimination of budgetary subsidies would have been more successful in Russia had the public sector remained centralized. However, I can approach this hypothesis indirectly by exploring the intra-regional decentralization that occurred. With the tradition of looking to higher authorities for guidelines, regional governments often mimic the federal-regional relationship when dealing with constituent localities. Thus off-loading responsibilities for price subsidies trickled down to the local level. As federal legislation leaves regional-local relationships completely to the discretion of regional governments, there is a significant variation across regions in the decentralization of both expenditure responsibilities and revenue-raising authority. At the same time the extent of government subsidies to enterprises also varies widely from region to region.

This paper aims to explore the link between the degree of fiscal decentralization and the extent of subsidization in Russian regions. A theoretical model establishes that for any given local share in total regional-local expenditures, decentralization of revenue-raising authority makes local governments reallocate funds from subsidies to more productive uses like public infrastructure. The intuition is that stronger reliance on revenues drawn from the local economic base increases the local government's opportunity costs of unproductive expenditures.

This theoretic prediction is tested on a panel of data for Russian regions in 1995 – 1997. The analysis yields positive estimates for the effect of an increase in the amount of resources available to local governments on the amount of budgetary subsidies. However, the effect of substituting a share of locally collected taxes for an equivalent amount of grants from the regional government reduces the amount of local subsides. Thus, tax instruments appear to be a superior form of financing decentralized expenditures than intergovernmental transfers. Similar results are obtained when the measure of subsidization includes tolerated tax arrears in addition to direct budgetary outlays on subsidies. The robustness of the results is secured by employing different econometric specifications for the region- and time-specific effects. Moreover, explicit treatment for possible endogeneity of decentralization only increases the magnitude of the estimates.

1. INTRODUCTION

Transition from socialism to capitalism has involved decentralization of both the economy and the government. Under the socialist system, the key role in linking discrepancies between centrally set prices and enterprise-specific costs was played by budgetary subsidies and turnover taxes. Liberalization polices initiated by central governments allowed prices to rise toward market clearing levels, which was accompanied by a mass reduction of central subsidies. However, in some sectors of the economy price controls have remained due to "social" and "political" factors (Schaffer, 1995). Moreover in multi-tier governments, subnational levels seem to be more sensitive to these factors because of their proximity to the constituency.[1] Hence, devolution of powers to the subnational level can hamper the elimination of the remaining subsidies.

A striking example of how decentralization of the government can interfere with market reforms is presented in the Russian transition experience. Tremendous regulatory and fiscal powers have been devolved to the regional and local governments in Russia (Shleifer, 1997). This has left the federal government with limited leverage on subnational[2] decision-making, which in turn resulted in a variety of economic policies pursued by different regions. Thus, in 1997 there was a tenfold difference between regions in the degree of subsidization via direct budgetary transfers to enterprises. At the same time, regional authorities have had full discretion in determining their fiscal relationships with constituent localities. Hence, the division of responsibilities for the functions shared between the two subnational levels of government also differed considerably from region to region.

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[1] Some evidence on the Russian Federation is provided by Mau and Stupin (1997) and the McKinsey Global Institute (1999). Mau and Stupin point out that subnational governments might be more dependent on their enterprises, especially on those providing regional employment, budget revenues, hard currency receipts, and social safety nets, and hence have less political resources to revise the practices of subsidizing the regional economy. The McKinsey Global Institute Report finds that restrictions on labor mobility combined with the fact that upper-level governments are not paying enough unemployment benefits prompt local governments to oppose restructuring and to subsidize their local firms.

[2] The term "subnational" refers to all levels below the federal or central level. For Russia I will distinguish the "regional level," referring to the 89 subjects of the Russian Federation (ethnic republics, *krais*, *okrugs*, *oblasts*, and autonomous areas) and the "local level," referring to cities and *rayons* and smaller entities.

This research aims to examine the link between fiscal decentralization and government support to enterprises at the subnational level. A stylized model of the interaction between regional and local governments demonstrates the importance of fiscal incentives embedded into the intergovernmental fiscal arrangements. The model traces the link between fiscal decentralization and the propensity of local governments to subsidize enterprises. The presence of this link is tested on a panel of 72 Russian regions over the period 1995 – 1997.

Beside direct budgetary subsidies there are also several channels of hidden government support to enterprises (tax benefits, preferential credits, tax exemptions, tax off-sets, tolerated tax arrears and others). However, inspection of the data shows that at the subnational level the flow of direct budgetary subsidies, on average at 6% of the Regional Economic Product, is much larger than the flow of tax arrears. Besides, direct budgetary subsidies are mostly sector specific and relate primarily to remaining price regulations, *e.g.*, residential utilities. Unfortunately, the gap-filling nature of such subsidies, allocated *ex post* as compensation to enterprises for losses attributed to price controls, creates a moral hazard on the part of the enterprises. Besides softening budget constraints[3] of affected enterprises, subsidies have been primarily contributing to fiscal imbalances but now at the subnational level.

The lack of counterfactual experience at the federal level does not allow one to directly test the hypothesis that Russia would have been more successful in eliminating budgetary subsidies and adjusting its fiscal accounts had the central government preserved control over the whole public sector. However, investigating the relationship between fiscal decentralization within Russian regions and the extent of subsidization from subnational budgets can give us some insights into this issue. The regional experience is highly relevant for answering this question because, regional governments, in their relationship with constituent localities, often mimic the federal government's relationship with the regions.

Starting in late 1997, the federal government has tried to pursue an expansive agenda for reforms aimed at bringing some structure to the intra-regional systems of fiscal relations. The results of my analysis should provide the reformers with some guidance as to the impact of fiscal reforms on the degree of subsidization of a regional economy. More spe-

[3] The notion of hard budget constraints originates with Kornai (1980) and indicates financial independence of enterprises from the government. Kornai argues that poor enterprise performance in socialist economies was associated with soft-budget constraints, that is, managers' knowledge that their losses would probably be covered by the authorities whatever their own performance was.

cifically, the analysis assesses the impact of decentralization of the revenue raising authority within regions on the extent of subsidization of the regional economy given the existing separation of functions between regional and local governments. This could guide new legislation aimed at reaching a clearer separation of expenditure responsibilities for shared functions if promotion of restructuring at the regional level is concerned.

The remainder of the paper is organized as follows. Section 2 describes the evolution of intergovernmental fiscal relations during the Russian transition. Section 3 demonstrates the scale and incidence of government support to enterprises at the subnational level in Russia. Section 4 develops a stylized model of interaction between regional and local governments and explores the impact of decentralization on subnational subsidies. Section 5 describes the data, states the research hypothesis and specifies an empirical strategy. Section 6 presents empirical evidence on the effects of fiscal decentralization on the local governments' propensity to subsidize enterprises in Russian regions. My conclusions and policy implications follow.

2. INTERGOVERNMENTAL FISCAL RELATIONS IN RUSSIA

The Russian system of government dates back to the mid-eighties, when Michael Gorbachev launched his *Perestroika* initiative. By the late eighties, the former legislatures (Soviets of Deputies) were transformed into representative forums in which deputies were elected at all levels in fair multi-candidate polls. After the 1993 standoff between the President and the Supreme Soviet, executive heads started to be elected directly[4] and thus they gained some autonomy from the legislature. Overall, Russian reforms of intergovernmental fiscal relations have lacked consistency due to an ongoing compromise between intended changes and various stakeholders' opposition.[5] Three main phases are distinguished in the literature: 1992 – 1993, 1994 – 1997, and the recent set of reforms introduced in 1997.

The 1992 – 1993 period was basically a continuation of the old Soviet system with a few changes. The most important change was shifting major expenditure responsibilities down to subnational governments.

[4] The Law on Appointment and Dismissal of Heads of Krai, Oblast, Autonomous Oblast, Autonomous Okrug, Rayon, Town, Urban Rayon, Settlement, and Rural Administrations of 1993

[5] For a thorough overview, see Martinez-Vazquez and Boex (2001), Wallich (1994), and Zhuravskaya (2000).

These expenditures included capital investments in many areas, social welfare, and price subsidies for social goods like food, medicine, local transportation, and public utilities.[6] At the same time regional and local governments were given little revenue-raising authority. Subnational revenues were drawn primarily from shared taxes and intergovernmental fiscal transfers in the form of negotiated "subventions." The center argued that due to fiscal pressures, it couldn't cede to subnational level control over any of the major tax bases.

Initially the 1991 Law on the Basic Principles of Taxation decreed federal personal and corporate income taxes to be shared with subnational budgets and the revenue from the value added tax to be entirely allocated to the federal budget. However, as the tax administration was very weak institutionally and often dominated by local authorities, secure proceeds from the VAT immediately became subject to sharing. As a result, subnational governments gained access to productive and elastic revenue bases but had little say in determining tax rates or tax bases. In 1993 the federal government gave subnational governments *carte blanche* to introduce new taxes. This freedom resulted in a plethora of minor taxes and nuisance charges that were abolished with the restoration of the federal list of allowed taxes in 1996.

In 1994 important reforms were undertaken in the system of fiscal relations between the federal government and regions. The budgetary autonomy of subnational governments had been strengthened with the introduction of the 1993 Constitution. Also, the federal government stopped the *ad hoc* "off-loading" of expenditure responsibilities to regional and local governments. However, the federal government continued the practice of unfunded mandates to subnational governments. Rates of sharing the major taxes between the federal government and regional governments were standardized across all regions. In addition, regional governments' share of revenue from the federal tax on enterprise profits was turned into a piggyback regional tax with a rate of up to 22 percent. The unification of tax-sharing rates across regions was offset

[6] This "off-loading" was closely linked to privatization. In the Soviet system, centrally planned enterprises were responsible for the provision of many basic goods and services. Hence, before being privatized such enterprises maintained huge social assets: housing, kindergartens, hospitals, and recreation facilities. Privatization was accompanied by the process of divestiture, meaning a transfer of social assets and the responsibility for their financing to municipalities. In fact, enterprises faced a choice either to maintain the infrastructure and partially off-set liabilities from the Housing Maintenance Tax, which is 1.5% of enterprise turnover, by the amount of expenses incurred or divest and pay the turnover tax in full (Alm and Sjoquist, 1995; Commander and Schankerman, 1997).

with the introduction of a formula-driven mechanism of equalization transfers. In addition, the federal government maintained the *ad hoc* mechanism of "mutual settlements."[7]

Since the end of 1997 the federal government has tried to pursue an expansive agenda for reform stated in the *Concept of Reform of Intergovernmental Fiscal Relations in the Russian Federation.* The *Concept* calls for a fundamental change in the system of federal transfers and also for bringing some structure to the intra-regional systems of fiscal relations. While the inter-budgetary relationships between the federal government and the regions are defined more or less clearly in the constitution,[8] the relationships between the regional governments and constituent localities are left to the discretion of regional authorities. Hence, the division of responsibilities for the functions shared between the two subnational levels of government considerably differs from region to region.

Before proceeding to the empirical evidence on fiscal decentralization in Russian regions, I would like to summarize numerous discussions on the definition and empirical measurements of this subject. Public finance economists define decentralization as the process of empowering local government units with some autonomy in decision-making. Three forms of this process have been distinguished in the literature: deconcentration, delegation, and devolution (See Bird, 1993; Bird and Vaillancourt, 1998; and Martinez-Vazquez and McNab, 1998). Through deconcentration the central government gives some autonomy to its local offices that are appointed by and accountable to the higher hierarchy. Under delegation locally elected government bodies assume new responsibilities subject to strict regulations by the upper-level government. The process of devolution establishes complete autonomy of locally elected government bodies in their exclusive spheres of responsibility.

According to these definitions, the evolution of intergovernmental relations in Russia presents a mix of delegation and devolution. Devolution is

[7] These are non-budgeted and primarily negotiated funds that are made public after budget execution. A great deal of these are in the form of tax exemptions from federal taxes available to regional energy suppliers. Regional administrations trade these exemptions for the bills of exchange issued by regional utility suppliers. The bills of exchange are transferred to local governments under the mutual settlements account so that localities can cover overdue payables to energy suppliers.

[8] Articles 71 and 72 assigned expenditure responsibilities between the Federation and regional governments with great ambiguity that was tried to be resolved through subsequent federal laws or bilateral fiscal treaties between the federal government and individual regions.

more prominent in the federal-regional sector. For instance, regional governments are solely responsible for financing public transportation and fire protection. However, in the regional-local sector many functions are shared between the two levels of government without a clear division of responsibilities. Restricted in the ability to structure their own revenue systems, local governments depend on the revenue decisions of the regional government. Thus, localities receive funding which is just enough to cover expenditures approved by the upper-level government. This limits local government's autonomy and undermines its accountability to the constituency.

The definition of decentralization suggests that it is a multi-faceted process. At least three distinct characteristics jointly constitute this concept: authority, autonomy, and accountability. Thus, no single-dimensional measure can capture the true degree of decentralization. Some approaches to measuring the extent of fiscal decentralization have been suggested in recent empirical studies on the link between fiscal federalism and economic development.[9] The suggested measures capture three essential aspects of decentralization: participatory allocation, strategic interaction, and fiscal incentives.

The first aspect relates to the share of general public spending that falls under the authority of local governments, and is therefore subject to the merits and dangers of decentralized decision-making. This aspect can be measured as a ratio of subnational government spending to general government spending. However, such a ratio can be misleading if local governments act simply as spending agents of the upper-level governments and are constrained by mandates imposed on them.

The second aspect of decentralization concerns the number of parties involved in the decision-making process. All other things being equal, more local governments (more fragmentation) would imply higher fiscal decentralization. This can have several interpretations: degrees of freedom for tailoring public goods to heterogeneous preferences; intensity of competition among jurisdictions; opportunities to negotiate a deal involving several bureaucracies; *etc*. This aspect is also connected to diseconomy of scale, inter-jurisdictional disparities and moral hazards on the part of localities.

[9] For a thorough discussion see Bahl and Linn (1992) and Guess *et al*. (1997). Econometric applications can be found in Davoodi and Zou (1998), Huther and Shah (1998), Jin *et al.* (1999), Woller and Phillips (1998), and Zhang and Zou (1998).

The third aspect of decentralization relates to local governments' feedback through local revenues.[10] This can be measured as the elasticity of local revenues with respect to the local economic base. Alternatively it could be measured as the share of local revenues that is drawn from the local economic base (as opposed to intergovernmental transfers). This measure should capture the incentives of local government to promote development or to cap spending. A dynamic generalization of this measure captures the ratchet effect that is off-setting an increase in localities' own revenues with a decrease in grants.

In the Russian context, measuring fiscal incentives boils down to an assessment of the revenue-sharing scheme. Federal tax legislation does not allow subnational governments to introduce taxes on any significant revenue base. The only exception is the property tax, which has substantial administration costs if it is to generate adequate tax revenues. Unfortunately, in Russia, all tax payments to all levels of government are collected by the federal tax service,[11] which has no incentives to invest in the administration of local taxes. Thus, the bulk of subnational revenues comes from shared taxes, either through tax revenue retention at the point of collection or through redistribution via intergovernmental fiscal flows.

In this paper I measure fiscal incentives by using the retention rate of tax collections in localities by local governments.[12] On the one hand, this measure indirectly indicates the share of local spending that is tied to the local revenue base as opposed to the share of expenditures funded with intergovernmental transfers and thus effectively subsidized by other localities. On the other hand, this measure captures the magnitude of opportunity costs incurred by local governments as a result of interventionist policies that retard development. This is a core feature of this paper and thus should be emphasized. Any non-zero tax revenue retention rate implies strictly positive elasticity of local revenues with respect to

[10] Often this aspect of decentralization is referred to as "enabling markets and fiscal instruments to hold local officials accountable" (*e.g.*, Ahmad, 1997).

[11] In all localities, tax payments to all levels of government are collected by a local branch of the federal tax service. Then proceeds from taxes assigned exclusively to localities and regions are transferred to an appropriate budget while exclusive federal and shared tax revenue is transferred to a local branch of the federal treasury. It is the local treasury office that splits the shared tax revenue between the budgets of the different levels of government according to fixed sharing rates. This way the federal government keeps track of all collections from every region and their allocation to all levels of governments.

[12] This measurement of regional-local sharing excludes tax collections remitted to the federal budget.

the local economic base (provided that an increase in the tax base is not entirely offset by a decrease in grants). However, higher rates of tax revenue retention imply higher losses to local governments resulting from the same loss in economic activity.

Below I use some modifications of the empirical measures described above in order to illustrate the development of fiscal decentralization in Russian regions from 1992 – 1997. Table 1 shows the local government's share in consolidated regional-local expenditures. The mean share of local governments in consolidated regional expenditures was stable at the level of about 64 percent. However, there were wide variations among regions that persisted throughout these years. In 1997, for example, local government spending in the Nenets Autonomous Area accounted for only 29 percent of total regional-local expenditures in contrast to the Perm Oblast, where local government spending was 85 percent.

Table 1. Local Government's Share in Consolidated Regional-Local Expenditures, 1992 – 1997.

	1992	1993	1994	1995	1996	1997
Mean	63%	63%	63%	64%	66%	64%
Median	65%	66%	64%	67%	69%	67%
Max	100%	100%	100%	84%	87%	85%
Min	0%	0%	0%	0%	0%	0%
Coefficient of Variation	0.24	0.25	0.24	0.23	0.24	0.24

Source: Calculated from Russian Ministry of Finance data.

Note: The maximum of 100% is observed in the Ingush Republic and Ust-Orda Buriat Autonomous Okrug as a result of no regional expenditures.

Table 2 reveals that the local government's share in consolidated regional collections was less stable than its share in consolidated regional expenditures. The mean/media share of local government's collections exhibits two jumps. In 1994 the mean share of local government's collections in consolidated regional collections increased from 45 percent to 60 percent. That year the share of local government's collections in GDP was also at its decade maximum of 7 percent (Table 3). A smaller

jump can be identified in 1996, when the median share of local government in consolidated regional collections increased to 63 percent.

Table 2. Local Government's Share in Consolidated Regional-Local Revenues from Own and Assigned Sources, 1992 – 1997.

	1992	1993	1994	1995	1996	1997
Mean	48%	45%	60%	59%	63%	61%
Median	51%	47%	59%	59%	64%	63%
Max	79%	100%	100%	94%	94%	93%
Min	0%	0%	0%	0%	0%	0%
Coefficient of Variation	0.34	0.39	0.28	0.26	0.26	0.26

Source: Calculated from Russian Ministry of Finance data.

Note: The maximum of 100% is observed in the Ust-Orda Buriat Autonomous Okrug as a result of no regional collections.

Table 3. Distribution of Pre-Transfer Revenues between Levels of Government, 1992 – 1997 (% of GDP).

	1992	1993	1994	1995	1996	1997
Regional Budgets	7.0%	9.0%	7.7%	7.3%	6.5%	7.8%
Local Budgets	6.2%	6.9%	7.0%	6.3%	6.4%	6.9%
Total Subnational	13.1%	15.9%	14.7%	13.6%	12.9%	14.7%

Source: Calculated from Russian Ministry of Finance data.

Although the two jumps narrowed the discrepancy between the local government's share in consolidated regional revenues and its share in consolidated regional expenditures, it does not necessary mean an improvement in the vertical fiscal balance at the local level. A significant portion of consolidated regional expenditures is funded with federal grants. Thus, even if consolidated regional collections are allocated between the regional and local governments in correspondence with their expenditure responsibilities, local government's fiscal accounts can still be unbalanced unless an adequate share of federal grants is passed on by the regional government to localities.

Presented indicators of fiscal decentralization show that as of 1997, on average, 64 percent of subnational expenditures are carried out by local governments. At the same time only 61 percent of subnational tax col-

lections are directly assigned to local governments. The gap is filled with intergovernmental fiscal transfers. Moreover, a tremendous variation in both the aspects of decentralization across regions persists throughout the years

3. SUBNATIONAL SUBSIDIES

In general terms a subsidy can be defined as a government intervention that reduces the price paid by a consumer below what it would be otherwise (a consumer subsidy) or increases the price received by a producer above the market level (a producer subsidy).[13] In socialist economies, government transfers to enterprises constituted a key element of the price administration system, bridging centrally set prices and enterprise-specific costs. However, these interventions might not fit the definition provided above. There were no market prices in socialist economies, and thus financial transfers to enterprises were only altering artificially set prices.

However, after the economy had been liberalized, residual transfers from the government became an obstacle to the efficient allocation of resources as determined by market forces. Moreover, as Soviet firms provided higher shares of social benefits in labor compensation compared to other countries of Eastern and Central Europe, Russia inherited more subsidization of the economy in the start of transition (Balcerowicz and Gelb, 1994; Commander and Schankerman, 1997; Shaffer, 1995). The policy of price liberalization let prices rise to market-clearing levels resulting in dramatic cuts in subsidies (see Table 4). However, as prices rose and central subsidies decreased, subnational governments often intervened for "social" or "political" reasons.[14]

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[13] For a discussion on the definition and measurement of government subsidies, see Schwartz and Clements (1999).

[14] In the short run, there might have been an economic rationale for these interventions. Commander and Schankerman (1997) argue that the divestiture of social assets by enterprises might result in "under-consumption of merit goods arising from the lagged wage adjustment" after removing social benefits from the total labor compensation. This prompts a transitional system of income support. However, if ill-designed, this income support program can have disastrous fiscal consequences. First, if income redistribution is not managed by the center, it is likely to cause greater inter-regional inequality as poor localities scare off businesses with the excessive fiscal burden of the program while fiscally rich localities (*e.g.* oil-rich) exploit their pecuniary fiscal advantage. Additional inefficiency might result from neglecting the incentive issues in either the supply or demand for the concerned benefits.

Table 4. Government Support to Enterprises in Russia, 1992 – 1997 (% of GDP).

	1992	1993	1994	1995	1996	1997
Direct subsidies from the federal budget	5.8%	2.5%	3.1%	2.2%	1.6%	1.8%
Flow of tax arrears to the federal budget	n.a.	n.a.	n.a.	1.44%	1.82%	1.31%
Direct subsidies from subnational budgets	5.3%	6.8%	7.3%	5.2%	6.3%	6.9%
Flow of tax arrears to subnational budgets	n.a.	n.a.	n.a.	1.27%	1.51%	0.81%

Source: Russian Statistical Yearbook, 1998.

Note: Here tax arrears include rescheduled payables.

The central government's strategy was to reduce the fiscal deficit by discontinuing financial transfers to enterprises from the center. In 1992, total government support to enterprises amounted to 30 percent of GDP (Alfandari *et al*., 1996). Based on a representative survey of enterprises in 1992 – 1994, the authors found that only 15 – 25 percent of this amount took the form of direct budgetary subsidies and investment grants (see Table 4). The largest share, over one third, was constituted by directed credits to enterprises from the central bank. Until the end of 1994, the central bank was providing directed credits to industry, arguing that tight money would leave enterprises without working capital. The second largest form of government support in Alfandari *et al*.'s survey was presented as tax benefits accounting for 16 – 34 percent of the total. The rest of the subsidies were made up by transfers from sectoral extra-budgetary (ministerial) funds.

In autumn 1993, the central government took drastic measures to reduce subsidization of the economy. The central bank was instructed to phase out the directed credits to enterprises. At the same time individual tax benefits to enterprises were revised. Price subsidies were significantly reduced at the federal level, while the right to maintain subsidies was delegated to subnational governments. However, the reduction of explicit transfers to enterprises was accompanied by the development of implicit subsidization. In a recent World Bank study (Pinto *et al.*, 2000), it is estimated that implicit subsidies from the general government grew to over 6 percent of GDP in 1998 from below 4 percent in 1994. About 70 percent of the implicit subsidies are accounted for by tax arrears and 30 percent are made up by inflated prices in tax off-sets and government procurements. At the subnational level, inflated prices used in government procurement accounted for more than 50 percent of all implicit

subsidies. Commander *et al*. (2000) present clear evidence that local governments engage in non-monetary transactions primarily with loss-making enterprises. By contrast, the federal government seems to accept in-kind tax payments even from solvent enterprises.

The decentralization of 1992 – 1997 left the federal government with limited leverage on subnational decision-making, which in turn resulted in differing economic policies pursued by different regions. In particular, many regions resumed price controls and regulations. Some regions even resorted to such discriminatory practices as forced distribution of production at the local level. Thus, the central government solved the short-run fiscal problem at the expense of losing control over further liberalization of the economy.

As a result, the extent of enterprise subsidization from subnational budgets varied significantly among regions (Freinkman *et al.*, 1998). Empirically, the degree of subsidization can be measured as a ratio of gross budgetary outlays on subsidies[15] to the total budget expenditures or to the size of regional economic product (see Table 5). As of 1997 there was a tenfold difference between regions in the degree of subsidization via direct budgetary transfers to enterprises. Subsidization via tolerated tax arrears[16] varied even more substantially. Ideally a measure of subsidization should include all channels of government support, including tax benefits, preferential credits, tax exemptions and tolerated tax arrears in addition to direct budgetary subsidies. However, as Pinto *et al.'s* (2000) study and Table 4 suggest, direct budgetary subsides constituted the major form of government support at the subnational level.

The direct budgetary subsidies developed at the subnational level are for the most part very sector specific. Table 6 presents more detailed data on the sectoral distribution of the direct budgetary transfers to enterprises. Sectors that continue to receive substantial subsidies are residential utilities (in particular, central heating), transportation, and agriculture.[17] Thus, the bulk of the direct budgetary subsidies can be

[15] In this paper, data on explicit budgetary subsidies are taken from reports on the execution of subnational budgets, which are filled out according to the budget classification introduced by the federal Ministry of Finance. The classification follows the United Nations' System of National Accounts (SNA) that defines subsidies as "current unrequited government payments to enterprises on the basis of their production, sales, or imports."

[16] Due to the lack of data, in this paper I consider only overdue tax arrears thus ignoring tax liabilities that have been rescheduled, written off or offset.

[17] Subsidies to different sectors of the economy are provided by different levels of government. Regional governments are responsible for agriculture, manufacturing, and inter-city transportation while localities subsidize housing, public utilities, and city transportation.

Table 5. Summary of Subnational Subsidization Indicators, 1995 – 1997.

	1995	1996	1997
Subnational budgetary subsidies as a share of consolidated regional expenditures			
Mean	10%	19%	28%
Median	8%	19%	28%
Max	36%	48%	52%
Min	0%	0%	5%
Coefficient of Variation	1.03	0.57	0.33
Flow of tax arrears to subnational budgets as a share of consolidated regional expenditures			
Mean	6.1%	3.6%	6.4%
Median	5.1%	3.1%	5.2%
Max	17.7%	13.7%	30.7%
Min	0.4%	−2.6%	0.6%
Coefficient of Variation	0.97	1.41	0.78
Subnational budgetary subsidies as a share of Regional Economic Product			
Mean	2.0%	4.1%	6.8%
Median	1.4%	3.8%	6.4%
Max	15.3%	17.8%	22.1%
Min	0.0%	0.0%	2.1%
Coefficient of Variation	1.19	0.70	0.45
Flow of tax arrears to subnational budgets as a share of Regional Economic Product			
Mean	1.15%	0.71%	1.41%
Median	0.94%	0.57%	1.24%
Max	3.09%	2.57%	5.99%
Min	0.28%	−0.65%	0.19%
Coefficient of Variation	0.60	0.76	0.66

Source: Calculated from Russian Ministry of Finance and Ministry of Taxation data.

Notes: 1) These descriptive statistics are calculated over a sample excluding sixteen out of eighty-eight regions. These excluded regions are nine autonomous areas[18] and seven *oblasts* (the equivalent of a state) within whose boundaries these autonomous areas are located. The reason is that the official statistics report the overall economic product produced within the boundaries of an *oblast* thus making it impossible to split the economic product among independent regions located one inside another; 2) Here tax arrears exclude rescheduled payables to subnational budgets.

[18] As equal subjects of the Russian Federation, the autonomous areas are independent from surrounding *oblasts* and have their own representative and executive branches of regional government, budgets and systems of local self-government.

Table 6. Sectoral Distribution of Subnational Budgetary Subsidies (% of total subsidies), 1995 – 1997.

Sector of Economy	1995	1996	1997
Manufacturing, energy and construction	8.2%	8.4%	2.9%
Agriculture and fishing	9.9%	10.9%	12.8%
Nature protection	1.1%	0.7%	0.3%
Transport, roads and telecommunication	21.6%	15.9%	12.6%
Development of market infrastructure	0.2%	0.1%	0.3%
Housing and utilities	58.0%	63.2%	68.9%
Mass media	0.9%	0.7%	0.8%
Other	0%	0%	1.4%

Source: Calculated from Russian Ministry of Finance data.

characterized as the result of remaining price controls and social/political factors.[19] Although the range of price controls and regulations might be comparable to those observed in Western Europe, the scale of subsidization (over six percent of GDP or thirty percent of subnational budget expenditures) is enormous.

Unlike direct budgetary subsidies (going mostly toward residential utilities, public transportation, and agriculture) the distribution of tolerated tax arrears exhibits a different pattern (see Table 7). About two thirds of overdue tax liabilities accumulated at the subnational level by the end of 1997 originate in manufacturing and construction. However, this might merely reflect the contribution of these two sectors to total tax liabilities. Table 8 suggests that in all sectors except transportation, compliance on liabilities owed to subnational budgets is higher than on those owed to the federal budget. This can be explained by the fact that in all localities

[19] The fact that most of the subsidies support public utilities raises the issue of enterprise ownership. However, as theory and evidence suggest, "privatizing public utilities is primarily about ownership rather than control, as utilities face remarkably similar regulation under public or private ownership." (Newbery, 1996). More to the point, Earle and Estrin (1998) present some evidence that "privatization and subsidy reduction are substitutes, that privatization and competition are complements [when the latter is measured as the geographic scope of markets], and that competition and subsidy reduction are independent, in their impacts on Russian enterprise productivity." Also Alfandari *et al.* (1996) found that outsider-controlled privatized enterprises do better than insider-controlled entities in extracting subsidies from the Russian government.

tax payments to all levels of government are collected by a local branch of the federal tax service, which is *de jure* independent from subnational governments and their willingness to tolerate arrears.

Table 7. Tax Arrears by Sector in 1996 – 1997, annual flow (as % of GDP).

Sector of Economy	1996			1997		
	General Government	Federal Government	Subnational Governments	General Government	Federal Government	Subnational Governments
Manufacturing	1.69%	0.96%	0.73%	1.45%	0.69%	0.76%
Construction	0.24%	0.11%	0.13%	0.24%	0.10%	0.14%
Transport	0.23%	0.08%	0.15%	0.39%	0.15%	0.25%
Agriculture	0.12%	0.02%	0.09%	0.15%	0.05%	0.10%
Other	0.00%	0.02%	−0.02%	0.00%	0.00%	0.00%
Total	2.27%	1.18%	1.09%	2.23%	0.99%	1.24%

Source: Calculated from Russian Ministry of Taxation data

Table 8. Tax Compliance by Sector in 1996 – 1997.

Sector of Economy	1996	1997		
	General Government	General Government	Federal Government	Subnational Governments
Manufacturing	84.80%	87.04%	84.63%	88.67%
Construction	88.57%	87.15%	86.17%	87.77%
Transport	94.18%	91.54%	94.40%	87.95%
Agriculture	68.87%	61.41%	50.99%	65.20%
Other	99.99%	100.01%	100.00%	100.02%
Total	90.68%	90.73%	89.80%	91.35%

Source: Calculated from Russian Ministry of Taxation data

Higher compliance on liabilities to subnational budgets is also compatible with the opposite hypothesis of "regional protection" (see Bahl and Wallich, 1995, p. 347; and Shleifer and Treisman, 2000). This line of rea-

soning dates to the time of "dual leadership," when local finance departments were subordinate both to the turned-independent subnational governments and to the federal Ministry of Finance. This dual coordination was eliminated as the federal government established local offices of the Federal Treasury and Ministry of Taxation to serve federal needs in every locality. However, the federal servants were recruited mostly from local finance departments and thus felt competing loyalties. Hence, the hypothesis of "regional protection" states that federal tax collectors might be encouraged by local administration to overlook local enterprises' liabilities to the federal government.

It is not the aim of this paper to test competing hypotheses explaining the nature of tax arrears. However, in order to evaluate the impact of fiscal decentralization on subsidization, I have to consider possible substitution between direct budgetary subsidies and tax arrears. Alfandari *et al*. (1996) argue that tax arrears are very similar to subsidized directed credits. At the same time the authors find no strong statistical evidence of a substitution effect between tax arrears and subsidies. They suggest that government can only be "a passive party in this process." Thus, I have reasons to believe that tax arrears might serve as implicit subsidization, but I cannot expect them to be perfect substitutes for direct budgetary subsidies.

The sectoral distribution of subsidies suggests that there might be some social, political or even economic reasons for these interventions. In other words the distortions to market activities caused by subsidization could be aimed at achieving an economic outcome that is more desirable to decision-makers than what would occur otherwise. For example, a price cap on utilities can theoretically prevent a welfare loss from the under-consumption of these goods as a result of monopoly pricing. Subsidization of necessities can serve as a cushion against transitory losses of purchasing power resulting from liberalization of prices. Finally, provision of goods and services by state-owned enterprises (*e.g*., public transportation) below the cost of production can meet some social policy objectives.

Regardless of the reasons for government interventions, any given form of implementation is likely to be characterized by a certain degree of inefficiency. First, a pursued policy can fail to achieve the desired goals. For example, one of the declared goals of subsidizing Russian agriculture is to secure domestic production and thus protect the poor, who cannot afford buying imported foodstuffs. However, because it is done by subsidizing the inputs to agricultural production (fertilizers, seeds, fuel, *etc.*), it might happen that the benefits are reaped by producers or intermediaries rather than by the intended beneficiaries. Moreover, even

if subsidization of inputs indeed translates into lower consumer prices, it benefits all consumers including the non-poor and thus may entail substantial waste.

Even when social or political benefits of subsidization can be effectively achieved, they have to be weighted against their economic costs. Financing of subsidies brings about market distortions no matter what form it takes: taxation, public debt, or emission of money. Taxation distorts resource-allocation decisions unless it is done in a lump-sum manner. Accumulation of public debt crowds out private investment and eventually, as it happened in Russia, can lead to a financial crisis. Inflation creates transaction costs for businesses thus hampering economic growth.

Besides indirect losses from subsidization related to its fiscal burden, we also have losses due to the distortion of market activities caused by subsidies. By diverging prices and production costs, subsidies alter the incentives of economic agents, and thus can generate rent-seeking behavior. In transitional economies there is a special form of rent-seeking that is associated with soft-budget constraints. With so many enterprises that are not viable in the new market environment, we observe a unique phenomenon described as the "demise of organizations." (Kornai, 1998). Facilities that cannot generate any profits, rather than being shut down, are used for squeezing subsidies out of the government. Such activities, although not compatible with maximization of profits, are perfectly rational in the context of some subsidization policies.

Depending on their nature, different means of subsidization might have different impacts on economic outcomes. As pointed out by Qian and Roland (1998), subsidies do not present soft budget constraints if enterprises do not expect to be bailed out in cases of bad financial performance. In this case subsidies merely internalize the true social value of underpriced goods. However, Roland (2000, p. 287) argues that based on the past record of government-firm relationships in Russia, one can suspect a strong correlation between the extent of subsidization and the softness of budget constraints faced by enterprises. Tolerated tax arrears present even stronger evidence of the weak financial discipline enforced by the government.

The hardness or softness of budget constraints introduced with subsidization depends on the distribution of bargaining power between the recipient and the government and the ability of both sides to commit themselves and to produce credible threats. Segal (1998) shows that a local monopolist can extract subsidies equal to the welfare loss from discontinued production. That is, the government, when introducing a price

cap, might be willing to compensate the producer only for the difference in revenues between the fixed price and the monopoly price. However, if all the bargaining power is on the producer's side (which is likely to be the case for a monopoly — consider a giant boiler threatening to cut off the whole city), the government might have to transfer the total consumer surplus as a subsidy to the producer.

In Russia, the amount of subsidies is determined ex-post, after enterprises incurred operating losses attributed to price controls. Needless to say, under these arrangements, enterprises are discouraged from either cost containment or revenue mobilization. A typical residential building in FSU countries "suffers high energy losses and inefficiencies compared to buildings in Western countries with similar climates" (Martinot, 1997). It takes proper incentives for housing and utility companies to adopt energy-saving technologies. Thus, in order to phase out subsidies, local officials would have to introduce more effective utility regulations based on performance measures, which require some administrative efforts.

Carrying out the Housing and Utilities Reform, launched in 1990, is still a daunting task for Russian policy makers. The main goals of the reform are to eliminate cross-subsidization of one category of consumers by others, to expand cost recovery, and to challenge the monopoly power of network utility distributors. Greater cost recovery is pursued both through cost reduction and sharing cost with final consumers. Cost sharing implies targeted subsidies to low-income households instead of transfers to utility companies. While steadily increasing since 1994, as of 1997, cost recovering was still at the level of 40% of actual costs in housing and utilities (and less than 60% in public transportation).

Even if a firm has no monopoly power and its assets are too obsolete to be put to any productive use, its mere presence may hamper the development of a healthy private sector. As Frydman and Rapaczynski (1994) argue, such firms "constitute a corrupting influence, perverting the incentives and objectives of private entrepreneurs." In addition, by keeping non-viable companies afloat with subsidies, the state effectively imposes a fine on productive firms. Moreover, these funds could bring about even more new businesses if resources were invested into local infrastructure (roads, telecommunications, human capital, law and order, *etc*.) instead.

The data presented in this section demonstrate substantial variation among regions in the degree of subsidization both via direct budgetary subsidies and tolerated tax arrears. Budgetary subsidies, on average at 6% of the Regional Economic Product, are mostly sector specific and relate primarily to remaining price regulations, *e.g*., residential utilities. Tax arrears with the annual flow on the order of 1% or so of the Regional Economic Product, are considerably smaller than the flow of direct sub-

sidies at the subnational level. Moreover, sectoral distribution of tax arrears seems to be driven by different criteria than those for budgetary subsidies. Unfortunately, a more detailed sectoral breakdown of tax data showing the amount of tax arrears originating in the sector of residential utilities is not available. I might have a different picture if I could look at the distribution of tax exemptions given by local authorities. Different channels of subsidization can have different justifications and consequences, yet the extent of subsidization can be an informative measure of the structural reforms in the region.

4. THE MODEL

In this section I develop a model featuring the stylized facts presented in the previous two sections. My analysis of the model aims at establishing a link between fiscal decentralization and the propensity of local governments to subsidize enterprises. From Section 2 we know that local governments have no discretion over the fiscal burden borne by the local economy, as it is entirely determined with the industry mix and the list of taxes prescribed in federal legislation. Moreover, localities cannot determine autonomously the aggregate size of their budgets, which is a sum of the local share of tax collections and lump-sum transfers from the regional government. However, according to Section 3, localities have some discretion in allocating the available funds between subsidies to enterprises and more productive uses like local infrastructure.

Subsidies complement price controls by covering operating losses incurred by regulated enterprises. Local governments can affect the amount of the losses/subsidies either by adjusting the price cap or introducing regulations that stimulate cost reduction (performance measures, contestability, *etc.*). Either measure is politically costly and therefore has to be weighed against the opportunity costs of subsidization, in part determined by intergovernmental fiscal arrangements. Thus my model examines budgetary responses of local governments to alternations in intergovernmental arrangements.[20]

The model is based on the interaction between a regional government and a local government. The regional government determines the amount of funds available to the local government and allocates the rest

[20] This model was motivated by the seminal paper by Qian and Roland (1998), who showed that due to fiscal competition among local governments, opportunity costs of subsidization by localities are higher under fiscal decentralization than in the case of fiscal centralization.

to the provision of regional public goods. The local government allocates public funds to the provision of local infrastructure and subsidization of inefficient local monopolies. In order to keep the model tractable I have to introduce a number of simplifying assumptions.

The representative resident of the locality is assumed to derive utility over consumption of (X, M, G_R), where X denotes the consumption level of a private good (the numéraire), M stands for the consumption level of the monopoly good (produced by the subsidized sector), and G_R stands for the consumption level of the regional public good. In the interest of simplicity, the resident's utility function is assumed to be quasi-linear in X, *i.e.*, $u(X, M, G_R) = X + u(M, G_R)$, where $u(\cdot,\cdot)$ is increasing in both arguments and strictly concave. The quasi-linear form of the utility function implies that income effects are captured solely by the consumption of the private good. Hence, demand for the monopoly good is described by $p = u_M(M, G_R)$ and does not depend on the income level.[21]

The local economic product Y is produced with two inputs: private capital K and local infrastructure I. Based on the low mobility of the Russian population, I assume the number of local residents to be fixed and treat all variables as being measured per capita. Furthermore, I assume that capital is perfectly mobile across local boundaries. This implies that, in equilibrium, $Y_K(K,I) = \bar{r}$ (investments are made up to the point where returns to private capital diminish to some exogenously given level $\bar{r}$ representing the opportunity cost of capital). I also assume that the local production function $Y(K,I)$ exhibits the following properties:

$$Y_I(K,I) > 0,$$

$$Y_{KK}(K,I) < 0,$$

$$Y_{II}(K,I) < 0,$$

$$Y_{KI}(K,I) > 0.$$

[21] Actually, this is true for income greater than some minimum level. Below this minimum, all income is spent on the consumption of the monopoly good thus determining its consumption level. For income greater than the amount sufficient to purchase the desired level of the monopoly good as determined by its price, all extra income is spent on the consumption of the private good. In my stylized model I assume that the representative resident's income is sufficient to pay the full cost of the standard level of consumption of the monopoly goods (heating, water supply, sewage, public transportation and domestic food).

The last property implies that investment in local infrastructure raises returns to private capital in the locality.

The local government receives transfers (T) from the regional government and retains a portion (λ) of the taxes collected from economic agents operating in the locality (both businesses and residents). The revenues are spent on subsidizing the local monopoly and building local infrastructure. Thus, the local government faces the following budget constraint:

$$\lambda\tau Y(K,I) + T = (c - p)M + I, \quad (1)$$

where: τ — expresses the general tax burden as a share of the value added produced in the locality, λ — stands for the rate of allocation of total tax revenues collected in the locality to the local budget, T — denotes budgetary transfers from the regional government to the local budget, c — stands for the unit cost of the monopoly good provision, p — is the regulated price of the monopoly good.

The local government's efforts to restructure local monopolies affect the average costs of the monopoly good production, *i.e.*, $c = c(e) \in [\underline{c}, \bar{c}]$, where e denotes the level of cost reducing effort, and $c' < 0$. Thus, local authorities face a trade-off between social welfare and disutility from undertaking restructuring efforts. Social welfare consists of the after-tax non-capital income less the resident's outlays on the monopoly good plus the social value of the monopoly and regional public goods. In other words, the local government's objective function can be expressed as

$$(1-\tau)\{Y(K,I) - \bar{r}K\} - pM + u(G_R, M) - v(e) \quad (2)$$

where: $u(G_R, M)$ — measures public utility derived from the consumption of the monopoly and public goods, and $v(e)$ — stands for the local government's disutility from undertaking restructuring efforts.

I assume that a regional government designs an intergovernmental fiscal scheme (T, λ) according to its objectives.[22] Given (T, λ), the interior

[22] In the empirical literature there is a discussion on the rationality of regional governments in Russia. For instance Zhuravskaya (2000) found that regional governments offset completely changes in localities' own revenues with changes in transfers. However, Alexeev and Kourlyandskaya (2001) argue that a rational regional government that is averse to transfers would never want to compensate a locality completely for a fall in local revenues as long as local authorities' efforts affect local revenues. Using data for localities of one *oblast*, they find no evidence that regional transfers tend to completely offset changes in local revenues. They do find, however, evidence of the ratchet principle in the region-local relationship.

solution for p, e and I to the local government's optimization problem subject to (1), $Y_K(K,I) = \bar{r}$, and $p = u_M(M,G_R)$ is characterized by the following equations:

$$\mu = -\frac{v'}{Mc'}, \tag{3}$$

$$\frac{1}{\mu} = 1 - \frac{c - p^*}{Mu_{MM}}, \tag{4}$$

$$\frac{(1-\tau)Y_I}{\left(-\frac{v'}{Mc'}\right)} = \left(1 - \lambda\tau\left[Y_I - Y_K\frac{Y_{KI}}{Y_{KK}}\right]\right). \tag{5}$$

In equation (3) μ is the Lagrange multiplier and denotes the shadow price of budget resources, that is, the marginal disutility of the local government associated with the marginal reduction of subsidies. Equation (4) shows that in the optimum, the Marginal Rate of Substitution (MRS) of a price increase for restructuring efforts should be equal to the Technical Rate of Transformation (TRS) of cost sharing into cost reduction. Here, the MRS is derived from the local government's objective function and the TRS is determined with the budget constraint (one ruble of cost reduction is equivalent in fiscal terms to less than one ruble of a price increase due to the adjustment of demand).

Equation (5) sets the MRS of local infrastructure for subsidies equal to the TRS of the first budget allocation into the other. The TRS is less than one because of the losses due to the outflow of capital. The expression in square brackets represents the marginal increase in the local tax base resulting from the marginal increase in the provision of local infrastructure. It is the sum of the direct impact Y_I and the indirect effect of capital inflow.

Now I can derive the comparative statics predictions for the local government's reaction to alterations in intergovernmental fiscal arrangements. Let (p^*, e^*, I^*) denote the local government's optimal solution and $S^* = \{c(e^*) - p^*\}M(p^*)$ be the resulting amount of subsidies. Then I can obtain the following results:[23]

Proposition 1: $dS^* = \gamma\, d\lambda + \delta\{\tau\, Y\, d\lambda + dT\}$ *and* $\gamma < 0$.

This result is an analogue of the so-called "Slutsky equation," which decomposes the comparative-static derivatives into two components, an

[23] Proofs are given in the Appendix.

income effect and a substitution effect. The sign of the substitution effect is derived from the second-order conditions while the income effect is indeterminate in sign and depends on the curvature of the objective function. In our case the tax revenue retention rate determines the opportunity cost of subsidization and thus affects the substitution of local infrastructure expenditures for subsidies. The income effect determines how extra revenues are allocated when the relative merits of different allocations are not affected.

The result stated in Preposition 1 emphasizes that the outcome of fiscal decentralization depends on how the decentralized expenditures are financed. Let us consider two alternatives: a transfer from the regional government and a share of tax collections that is *ex ante* equivalent to the amount of the transfer (that is, the equivalence is based on a current fiscal capacity *Y*, which might become different e*x post* in part due to government activities). Then the marginal propensity to spend on subsidies out of transfers is while the marginal propensity to spend on subsidies out of an equivalent amount of shared taxes is

$$\delta + \frac{\gamma}{\tau Y} < \delta \ .$$

Therefore, a switch from grants to the fixed retention rate of tax collections results in a smaller amount of subsidies allocated from a fixed size of the local budget.

Having obtained a prediction concerning the effect of fiscal decentralization on the marginal propensity to spend on subsidies, now I turn to the effects on the average propensity to subsidize. The average propensity to subsidize is traditionally measured as a ratio of subsidies to either the economic product or budget size.

Proposition 2: $\left.\frac{d\frac{S^*}{\lambda\tau Y + T}}{d\lambda}\right|_{\tau Y d\lambda + dT = 0} < 0$ *and* $\left.\frac{d\frac{S^*}{Y}}{d\lambda}\right|_{\tau Y d\lambda + dT = 0} < 0$,

provided that the marginal return to local infrastructure is less than the average return, *that is* $\Pi < \frac{Y}{I}$.

To interpret these statements, consider various intergovernmental fiscal arrangements (T, λ) representing the same level of spending decentralization: $\lambda\tau Y + T = \text{const}$. Then, higher rates of tax revenue retention λ result in lower average propensities to subsidize measured as a proportion of either budgetary resources or economic product. Overall, the comparative statics

analysis yields the prediction that due to the substitution effect, the decentralization of the revenue-raising authority reduces subsidization while the income effect of change in available resources is ambiguous.

The findings of my model can be related to the "flypaper effect" discussion, which concerns the taxing decisions of local governments in response to the allocation of grants. The "flypaper effect" refers to the empirical rejection of the "veil hypothesis," stating that for a broad class of collective-choice procedures, a grant to a community is equivalent to a set of grants directly given to the residents of that community. This implies that the propensity to spend on local public goods out of the received grant should be equal to the propensity to spend on local public goods out of local residents' income. Thus one should observe a similar response in local government size to intergovernmental transfers as to an equivalent increase in local residents' income. However, empirical studies reveal that local expenditures are much more responsive to an increase in intergovernmental revenues than they are to an increase in local residents' income (for a review see Hines and Thaler, 1995). Hence, the "flypaper effect" — money sticks where it hits.

Although, just like my stylized model, the "flypaper effect" deals with the budgetary response to intergovernmental transfers, it cannot be directly applied to the process in my study. In Russia local residents/governments have no discretion over the rates and bases of taxes and thus cannot determine autonomously the aggregate size of their budgets (Bahl and Wallich, 1995, p. 333). Thus, the equivalence between intergovernmental transfers and local residents' income does not hold. The only response of localities to a change in intergovernmental transfers would be a reshuffling across budget allocations. In my stylized model I have two allocations: local infrastructure and subsidies. I show that due to a price effect, the propensity to spend on subsidies out of shared taxes is less than the propensity to spend on subsidies out of lump-sum grants. However, if government subsidies can to some extent serve as tax rebates to local taxpayers,[24] then my results imply that shared taxes, which can be interpreted as point-of-collection grants, are "stickier" than lump-sum grants.

5. EMPIRICAL SUPPORT

In this section, I describe the data, state the research hypothesis derived from the model of Section 4, and specify an empirical strategy to test this hypothesis.

[24] I am indebted to Andrew Austin for this point.

5.1. Structure and Sources of the Data

All available data are annual from 1992 to 1997.

The budgetary data were obtained from Russian Ministry of Finance sources. In Russia all levels of government use the same centrally introduced budget classification of revenues and expenditures and submit reports on budget execution to the upper level government on a regular basis. Expenditures are reported by function, by economic character, and by spending agency. For every spending agency, expenditures are also classified by object. Thus, for example, I can determine how much a local housing and communal services department spent on contracting services (like street cleaning) and how much was spent on the distribution of subsidies to utilities companies.

The revenue section of the budget reports shows receipts from each tax allowed by the federal legislation and also gives some information on non-tax revenues. Receipts from user charges for public services are not included in budget reports as they are earmarked for and collected by enterprises under contract for the delivery of these services. Caution should be taken with regard to budget arrears and extra-budgetary funds. In Russia, budget execution is reported on a cash basis, thus excluding receivables and payables accumulated by the government. Also, as a way to avoid fiscal discipline, some portion of public funds is channeled through extra-budgetary funds. These funds are formed with budget allocations unspent in the past, "voluntary" contributions from local enterprises, tax penalties and other fines, and proceeds from paragovernmental ventures.

Information on tax collections from each region allocated both to the federal and subnational budgets is taken from Russian Ministry of Taxation sources. For each region, tax collections are reported by type of tax, by sector of economy, and by the level of budget that they are allocated to. Starting from 1994, the stock of tax arrears is reported by type of tax and by the level of budget it is owed to. In 1997 the stock of tax arrears is also reported for several sectors of the economy: manufacturing, construction, and trade. Only two budget levels are distinguished: federal and subnational, with the latter consolidating figures for the regional budget and the budgets of localities within that region.

All information on non-fiscal indicators derives from the 1998 Russian Statistical Yearbook. Information on the variation in the cost of social services among regions (which accounts for climate, landscape, *etc.*) is taken from the calculations of federal assistance to regions.

5.2. Sample

The new budget classification, based on internationally recognized principles, was introduced in Russia only in 1995. The budget classification in use before 1995 reported expenditures aggregated by sector of economy as it was done in the Soviet budget system. The data on regional spending reported to the Russian Ministry of Finance before 1995 does not allow one to classify expenditures by object (Freinkman and Haney, 1997). Hence, in my analysis I will focus on the period 1995 – 1997 to avoid problems of data inconsistencies.

I have budgetary data for all eighty-eight subjects of the Russian Federation excluding Chechnya. However, those indicators that are defined as a proportion of the regional economic product cannot be computed for nine autonomous areas and seven *oblasts* within whose boundaries these autonomous areas are located. The reason is that official statistics report economic product produced within the boundaries of a whole *oblast* thus making it impossible to split the product between independent regions located one inside another. Therefore for my regressions the sample is narrowed to 72 regions over 3 years.

5.3. An Empirical Version of the Theoretical Predictions

The theoretical model presented in Section 4 predicts that the amount of local subsidies is affected by fiscal incentives introduced with tax-sharing and the decentralization of budgetary resources. Let *i* index regions, and let *j* index individual localities within those regions. Then, a discrete time version of Proposition 1 can be written as

$$\Delta \frac{S_{ijt}}{N_{ij}} = \gamma \Delta \lambda_{ijt} + \delta \left\{ \frac{\tau_{ij0} Y_{ij0}}{N_{ij}} \Delta \lambda_{ijt} + \Delta \frac{T_{ijt}}{N_{ij}} \right\} + \varepsilon_{ijt}, \qquad (6)$$

where

$$\Delta \frac{S_{ijt}}{N_{ij}} = \frac{S_{ijt}}{N_{ij}} - \frac{S_{ij0}}{N_{ij}}$$

is the change in the per capita amount of subsidies in locality *j* since period 0; $\Delta \lambda_{ijt} = \lambda_{ijt} - \lambda_{ij0}$ is the change in the tax revenue retention rate for locality *j* since period 0;

$$\frac{\tau_{ij0} Y_{ij0}}{N_{ij}}$$

denotes the per capita amount of total tax collections in locality *j* in period 0;

$$\Delta \frac{T_{ijt}}{N_{ij}} = \frac{T_{ijt}}{N_{ij}} - \frac{T_{ij0}}{N_{ij}}$$

is the change in the per capita amount of transfers to locality *j* since period 0; ε_{ijt} is the error due to approximation.

Proposition 1 leads us to the following Hypothesis 1: $\gamma < 0$.

5.4. Measures of Decentralization and Issues of Aggregation

Unfortunately, my data do not allow me to estimate equation (6) at the level of individual localities. Available figures for local budgets are aggregated at the regional level. Thus, I don't have data on tax revenue retention rates for individual localities but the aggregated share of local governments in consolidated regional tax collections, that is

$$\lambda_{it} = \frac{\sum_j \lambda_{ijt}\tau_{ijt}Y_{ijt}}{\sum_j \tau_{ijt}Y_{ijt}}.$$

Hence I will employ region-level data as proxies for equation (6) variables aggregated across localities. The equation to be estimated has the following form:

$$\bar{s}_{it} - \bar{s}_{i0} = \gamma\left(\lambda_{it} - \lambda_{i0}\right) + \delta\left(\bar{d}_{it} - \bar{d}_{i0}\right) + X_{it}\chi + \alpha_i + \beta_t + \bar{\varepsilon}_{it}. \qquad (7)$$

where: $\bar{s}_{it}$ is the per capita amount of subsidies[25] in region *i* in period *t*; λ_{it} is the aggregated share of local governments in consolidated tax collections[26] in region *i* in period *t*; $\bar{d}_{it}$ is the period 0 projection of local per capita revenues for period *t* in region *i*, that is, the total per capita tax collections in period 0 times the tax revenue retention rate set for period

[25] Region-level data include subsidies allocated by the regional government in addition to those allocated by local governments. This contributes to the measurement error of the dependent variable.

[26] In the hypothetical case of a region having only one locality, this measure is equivalent to the rate of allocation of total tax revenues collected in the locality to the local budget. In a general case, this measure can serve as a proxy for the average rate of allocation of total tax revenues collected in localities to local budgets.

t plus the amount of lump-sum grants set for period t; X_{it} is a vector of variables controlling for other determinants of subsidization; α_i and β_t are region- and year-specific effects; $\overline{\varepsilon}_{it}$ is a random error term.

Hypothesis 1 can be rejected at the significance level if my panel data analysis yields a positive t-ratio $\hat{t}_\gamma$ for coefficient γ such that $\Pr ob\left(t > \hat{t}_\chi\right) < \theta$.

5.5. Endogeneity Problem

Intergovernmental arrangements that one observes in Russian regions is a result of factors that affect the decentralization of authority by regional governments and factors that affect local demand for fiscal resources. To study the effects of decentralization, I have to rely exclusively on the variation in decentralization that comes from the regional government's decisions. Indeed, factors that affect local governments' demand for budgetary resources can also have a direct effect on the extent of subsidization. For instance, localities that inherited more wasteful enterprises can make a stronger claim for budgetary resources. Thus endogeneity will bias the estimates of the effect of decentralization on the propensity to subsidize. The best response to this problem is a set of valid instruments — that is, variables that affect intra-regional decentralization but are uncorrelated with the factors that affect subsidization. Potential instruments are derived from Timofeev (2001), where cross-regional variation in subnational decentralization is explained with exogenous variables capturing the initial level of decentralization, urban concentration, land area, population density, ethnic diversity, natural resources endowment, and others.

5.6. Control variables

I would expect that my stylized model omits some region- and time-specific factors that affect local governments' budget allocations. Existing empiric studies on budgetary subsidies in Russia identify supply- and demand-side factors.[27] Supply-side variables characterize the availability of budgetary resources and the presence of competing fiscal pressures (*i.e.*, for allocations other than subsidies). Demand-side variables express the need for subsidies on the part of enterprises.

[27] See Alfandari *et al.*, 1996; Freinkman and Haney, 1997; Martinez-Vazquez and Boex, 2001; Orlov *et al.*, 2000; and Titov, 1997.

On the demand side the studies quote the provision of social services by enterprises (+), drops in exports (+), labor productivity (−), the percent of rural population (+), and the share of defense production (+) as significant determinants of subsidization. On the supply side, according to these studies, the determinants include per capita GRP (+), regions' own per capita budgetary revenues (+), per capita federal transfers (+), household income (+), life expectancy (+), population under working age (−), and doctors per 10,000 population (−). In addition, Orlov *et al.* (2000) find the regional political environment (measured as a percentage of votes cast for the communist party) to affect the extent of subsidization in the region.

Some of the above listed factors are endogenous to my model as the financial shape of enterprises is determined by local governments' restructuring efforts. Thus I will not be able to distinguish statistically between the impact of decentralization and that of the financial distress of enterprises. However, I can control for exogenously determined factors such as industry-wide shocks. For every region I compute an index of "healthy" sectors as a weighted sum of national indexes of sectoral production with each sector having a weight proportional to its share in the regional economy. On the supply side I can control for the initial level of GRP (in 1994) and for competing fiscal pressures as determined by the share of population over and under the working age, which requires more spending on healthcare and education.

Some part of the variation in the subsidization of social services can be explained with fundamental cost differentials across regions. Obviously, for the same level of cost-reducing efforts it takes more energy to heat a residential building in Siberia than to heat one on the Black Sea shore. To control for these factors I include region-level indexes of production costs in housing and utilities and transportation.

6. ESTIMATION RESULTS

Table 9 provides descriptive statistics calculated over the sample of observations pooled across regions and years. There is a wide variation in both the measures of fiscal decentralization that occurred since 1992. Change in the tax revenue retention rate has a mean of −1.5 percentage points and a standard deviation of 9.4 percentage points. Change in local revenues from tax-sharing and lump sum grants has a mean of −315 constant 1992 rubles per capita and a standard deviation of 5,217. Table 10 provides coefficients of pair-wise correlation for selected variables. The correlation between the two measures of decentralization is −0.01. The lack

of correlation is important for distinguishing between the substitution and income effects of tax sharing as predicted in the theoretic model.

Table 9. Descriptive Statistics.

Variable	Mean	Std. Dev.	Max	Min
Change in tax revenue retention rate since 1992	−0.015	0.094	0.224	−0.299
Decentralization of resources, thou. RUR per capita since 1992	−0.315	5.217	48.870	−20.275
Tax revenue retention rate in 1992 (share)	0.448	0.153	0.668	0.000
Population density (thou. persons/km^2)	0.198	1.086	8.770	0.0001
Land area (millions of km^2)	0.151	0.380	3.103	0.009
"Healthy" Sectors Index	0.861	0.050	1.026	0.735
Housing & Utilities Costs Index	1.122	0.507	2.845	0.754
Transportation Costs Index	1.460	1.324	10.481	1.000
GRP, millions RUR per capita in 1994	3.140	1.361	8.080	0.752
Population under working age (%)	23.239	3.559	35.800	17.700
Population over working age (%)	19.774	4.734	27.300	5.300
Change in the amount of subsidies (thou. RUR per capita)	−3.237	5.221	12.795	−42.420
Change in per capita amount of tax arrears (thou. RUR per capita)	0.798	0.908	6.231	−0.758
Change in a sum of per capita amounts of subsidies and tax arrears (thou. RUR per capita)	−2.440	5.317	17.939	−41.357

Table 10. Pair-wise correlation coefficients.

Change in tax revenue retention rate	Decentralization of resources	−0.010
Change in the amount of subsidies	Change in tax revenue retention rate	−0.252
Change in per capita amount of tax arrears	Change in tax revenue retention rate	0.140
Change in the sum of per capita amounts of subsidies and tax arrears	Change in tax revenue retention rate	−0.223
Change in the amount of subsidies	Decentralization of resources	0.226
Change in per capita amount of tax arrears	Decentralization of resources	0.322
Change in the sum of per capita amounts of subsidies and tax arrears	Decentralization of resources	0.277

6.1. First-Stage Results

Table 11 contains the estimates of the first-stage regressions for the two measures of decentralization. Both aspects of decentralization are statistically significantly related to the four variables excluded from the subsidization equation: the initial rate of tax revenue retention in 1992, the share of the largest ethnic minority in the total population, population density, and land area. The *F*-statistic on the joint significance of the four excluded instruments is 22.176 (the p-value is less than 0.001) for the change in the tax revenue retention rate and 3.698 (the p-value is less than 0.007) for the decentralization of budgetary resources. This suggests that the second-stage estimates shouldn't have biases resulting from weakly correlated instrumental variables (Bound *et al*, 1995).

Table 11. First-Stage Regressions: Parameters and Robust Standard Errors.

Dependent variable	Change in tax revenue retention rate	Decentralization of resources
Tax revenue retention rate in 1992 (share)	−0.489*** (0.052)	−4.483 (3.108)
Share of the largest ethnic minority	−0.178*** (0.061)	−3.471 (3.612)
Population density (thou. persons/km^2)	−0.043*** (0.007)	0.829** (0.411)
Land area (millions of km^2)	−0.021 (0.022)	−4.375*** (1.302)
"Healthy" Sectors Index	−0.303* (0.161)	43.592*** (9.545)
Housing & Utilities Costs Index	−0.021 (0.023)	−4.157*** (1.341)
Transportation Costs Index	−0.003 (0.007)	0.731* (0.440)
GRP, millions RUR per capita in 1994	0.032*** (0.007)	2.789*** (0.439)
Population under working age (%)	0.002 (0.004)	0.050 (0.248)
Population over working age (%)	−0.001 (0.004)	0.095 (0.212)
$F_{4, 203}$ —statistic, joint significance for the excluded instruments	22.176	3.698
Sample size	216	216
Adjusted R^2	0.37	0.28

Notes: All models include year effects.

* — statistically significant at the 10% level;

** — statistically significant at the 5% level;

*** — statistically significant at the 1% level.

6.2. The Effect of Fiscal Decentralization on Subsidies

First column of Table 12 shows Two Stage Least Squares (2SLS) estimates of equation 7) for one measure of subsidization: per capita budgetary subsidies in constant 1992 rubles. Period 0 is set to be

1992. The effect of a change in the tax revenue retention rate on the proliferation of subsidies is negative and significant at the 10%-level. A one-ruble equivalent switch from lump-sum grants to tax revenue retention results in

$$\frac{\gamma}{\tau Y} = \frac{-35.03}{14.61} = -2.40$$

rubles of reduction in subsidies. The effect of decentralization of budget resources is positive and significant at the 1%-level. An extra ruble made available to a local government either via shared taxes or lump sum grants results in a 2.78 ruble increase in subsidies. Thus, a marginal propensity to subsidize out of retained taxes is 2.78 − 2.40 = 0.38.

Table 12. Effects of Decentralization on Budgetary Subsidies.

Dependent variable	Change in per capita amount of subsidies		
Specification	2SLS: year dummies	One way random effects: years	Two way fixed effects
Change in tax revenue retention rate	−35.034* (19.063)	−4.821* (2.861)	−6.137* (3.198)
Decentralization of resources	2.780*** (0.788)	0.290*** (0.056)	0.059 (0.052)
"Healthy" Sectors Index	−108.482** (48.984)	22.539*** (8.141)	29.134* (17.432)
Housing & Utilities Costs Index	9.482* (5.092)	−2.472** (1.041)	–
Transportation Costs Index	−1.712 (1.138)	−1.166*** (0.332)	–
GRP, millions RUR per capita in 1994	−6.541*** (1.627)	−2.547*** (0.003)	–
Population under working age (%)	−0.559 (0.688)	−1.650*** (0.173)	−3.194*** (1.086)
Population over working age (%)	−0.815 (0.560)	−1.300*** (0.161)	2.706** (1.248)
Test statistic, omnibus overidentification test: $216*R^2$ (distributed $\chi^2_{\text{d.f.} = 2}$)	1.753		
Sample size	216	216	216
Adjusted R^2		0.46	0.89

Notes: All specifications include year effects. Standard errors are provided in parenthesis

* — statistically significant at the 10% level;
** — statistically significant at the 5% level;
*** — statistically significant at the 1% level.

In addition to the estimates of the effect of decentralization, Table 12 also shows coefficients for other covariates. I find the negative effects of growing sectors and of the 1994 level of Gross Regional Product on an increase in subsidies. Thus, these two variables characterize the demand for subsidies on the part of enterprises. The coefficient for the housing and utilities costs index is positive at the 5% significance level. The costs in transportation have a negative but statistically insignificant effect. The shares of the population under and over the working age have negative but statistically insignificant effects.

The last row of Table 12 presents results for the omnibus test of overidentification. This test attempts to show that variation in the four excluded instruments is not correlated with subsidization. Technically, it is a test of whether, after eliminating its correlation with fiscal decentralization and other covariates, subsidization is still correlated with the initial rate of tax revenue retention, the share of the largest ethnic minority, population density, and land area. The test statistic is distributed as χ^2 with two degrees of freedom (the number of excluded instruments minus the number of endogenous variables). The omnibus test fails to reject the null hypothesis that the excluded instruments affect subsidization only via their effects on intra-regional decentralization.

I also run a Hausman test that checks the validity of potential instruments based on the availability of as many true instruments as the number of endogenous variables. The test statistic is distributed as χ^2 with one degree of freedom. I tested the validity of each instrument assuming exogeneity of any two of the remaining three. The largest value of the static that I obtained is 2.9, which is below the 5% critical value of 3.8. Thus, if at least two of the excluded variables are valid instruments, then the Hausman test does not reject the null hypothesis that the remaining two instruments are also legitimate.

The last two columns of Table 12 report the estimates for two alternative specifications of the regression analysis. The middle column shows the estimates for the year-effects specification assuming the decentralization variables to be exogenous. The fixed- and random-effects estimates are very close, therefore the Hausman test favors random effects (presented in the table). The last column reports two-way-fixed-effect estimates. This specification excludes time-invariant covariates as their effects are captured by the region dummies. Both alternative specifications produce the same signs for the impact of decentralization as 2SLS does. However, the magnitude of these effects is much smaller and turns out to be insignificant for the decentralization of budgetary resources in the two-way fixed-effect specification.

Overall, Table 12 demonstrates that a switch from lump-sum grants to tax revenue retention has a statistically significant, negative effect on the amount of budgetary subsidies. Assuming intra-regional decentralization to be exogenous is likely to produce biased estimates of its impact on subsidization. The initial rate of tax revenue retention, the share of the largest ethnic minority, density of population, and land area appear to be valid instruments.

6.3. Alternative Measures of Subsidization

Section 3 reveals that explicit budgetary subsidies do not account for the whole subsidization. There are more implicit forms like tax benefits, preferential credits, tax exemptions, tax offsets, and tolerated tax arrears. I have data for the stock of tax arrears in 1994 – 1997. Thus I can calculate the annual flow of tax arrears in 1995 – 1997. Unfortunately, I do not have data on the flow of tax arrears before the decentralization began in 1992. However, knowing that the development of implicit subsidization mostly occurred after 1993, I can assume the flow of tax arrears to be zero in 1992.

Table 13 reports the estimates of the effects of fiscal decentralization on alternative forms of subsidization. The signs of the estimates are consistent for different econometric specifications and dependent variables. The estimated coefficients for the effects of fiscal decentralization on budgetary subsidies and tax arrears sum up to the estimated coefficient for the effects of fiscal decentralization on the sum of these two forms of subsidization. Thus, budgetary subsidies and tax arrears appear to be complementary forms of subsidization. The results support the hypothesis that increasing tax revenue retention lowers local governments' propensity to subsidize enterprises for any given level of decentralization of resources. None of the specifications can reject this hypothesis at the 30%-significance level.

7. CONCLUSIONS AND POLICY IMPLICATIONS

The main objective of this research was to provide some theory and evidence on the relationship between fiscal decentralization and the propensity of subnational governments to subsidize enterprises. In a stylized model of interaction between regional and local governments, I have demonstrated how intergovernmental fiscal arrangements affect local governments' propensity to subsidize inefficient monopolies. The model predicts that higher rates of tax revenue retention by local governments

Table 13. Effects of Decentralization on Budgetary Subsidies.

Specification	Measure of Decentralization	Dependent Variable		
		Change in per capita amount of subsidies	Change in per capita amount of tax arrears	Change in the sum of per capita amounts of subsidies and tax arrears
2SLS: year dummies	Change in tax revenue retention rate	−35.034*	−2.251	−37.275*
		(19.063)	(1.659)	(20.467)
	Decentralization of resources	2.780***	0.210***	2.990***
		(0.788)	(0.068)	(0.846)
One way random effects: years	Change in tax revenue retention rate	−4.821*	−0.471	−5.288*
		(2.861)	(0.418)	(3.002)
	Decentralization of resources	0.290***	0.016**	0.307***
		(0.056)	(0.008)	(0.058)
Two way fixed effects	Change in tax revenue retention rate	−6.137*	0.954	−5.183
		(3.198)	(0.988)	(3.494)
	Decentralization of resources	0.059	0.008	0.067
		(0.052)	(0.016)	(0.057)
	Test statistic, omnibus overidentification test: TR^2 (distributed $\chi^2_{\text{d.f.}=2}$)	1.753	1.875	1.376
Sample size		216	216	216

Notes: All specifications include year effects.
Standard errors are provided in parenthesis
* — statistically significant at the 10% level;
** — statistically significant at the 5% level;
*** — statistically significant at the 1% level.

raise their opportunity costs of subsidizing enterprises. Thus, such higher rates make local governments reallocate public funds to infrastructure

provision instead. At the same time, the effect of decentralizing budgetary resources solely depends on the curvature of residents' and local governments' utility functions. These theoretic predictions are in agreement with the results of my empirical analysis of a panel of 72 Russian regions over the period 1995 – 1997.

This empirical examination is highly relevant for current policy debates on the decentralization of revenue raising authority within Russian regions and the assignment of expenditure responsibilities between the two subnational levels of government. The presented findings suggest that decentralization of expenditures can result in more efficient budget allocations only if accompanied by the decentralization of revenue raising authority.

THE PROOF OF PROPOSITIONS

Proposition 1: $dS^* = \gamma\, d\lambda + \delta\{\tau\, Y\, d\lambda + dT\}$ *and* $\gamma < 0$.

Proof:

Implicitly differentiating the first-order condition for each choice variable and solving simultaneously, I obtain

$$\frac{\left|\bar{H}\right|}{\left|\bar{H}^{44}\right|} dI^* = \frac{v'}{Mc'} \tau\, \Pi\, d\lambda + \frac{\left|\bar{H}^{41}\right|}{\left|\bar{H}^{44}\right|} \{\tau\, Y\, d\lambda + dT\}, \tag{8}$$

where:

$\left|\bar{H}\right|$ — denotes the bordered Hessian determinant,

$\left|\bar{H}^{44}\right|$ — stands for the upper-left minor of the bordered Hessian matrix,

$\left|\bar{H}^{41}\right|$ — stands for the upper-right minor of the bordered Hessian matrix,

Π — stands for the marginal increase in local economic product resulting from the marginal increase in local infrastructure provision and is equal to

$$Y_I - \bar{r} \frac{Y_{KI}}{Y_{KK}}.$$

Taking the total differential of the local government's budget constraint (1) yields $dS^* = \gamma\, d\lambda + \delta\{\tau\, Y\, d\lambda + dT\}$. Substituting (8) for dI^* and rearranging gives

$$dS^* = (\lambda\tau\Pi - 1)\frac{\left|\bar{H}^{44}\right|}{\left|\bar{H}\right|} \frac{v'}{Mc'} \tau\, \Pi\, d\lambda + \left[1 - (\lambda\, \tau\, \Pi - 1)\frac{\left|\bar{H}^{41}\right|}{\left|\bar{H}\right|}\right] \{\tau Y d\lambda + dT\}.$$

The second order conditions imply[28] that

$\left|\bar{H}\right| < 0$ and $\left|\bar{H}^{44}\right| > 0$.

[28] This is valid only in the case of a regular maximum, that is if the Hessian matrix is negative *definite* subject to the constraint, which is a common assumption.

In addition from (5) it follows that $(\lambda\tau\Pi - 1) < 0$. Hence,

$$\gamma = (\lambda\tau\Pi - 1)\frac{\left|\bar{H}^{44}\right|}{\left|\bar{H}\right|}\frac{v'}{Mc'}\tau\Pi < 0.$$

Proposition 2: $\left.\frac{d\frac{S^*}{\lambda\tau Y + T}}{d\lambda}\right|_{\tau Y d\lambda + dT = 0} < 0$ *and* $\left.\frac{d\frac{S^*}{Y}}{d\lambda}\right|_{\tau Y d\lambda + dT = 0} < 0,$

provided that the marginal return to local infrastructure is less than the average return, *that is*

$$\Pi < \frac{Y}{I}.$$

Proof:

Taking the total differential of the local government's budget constraint (1) yields

$$d\frac{\left(c - p^*\right)M}{\lambda\tau Y + T} = \frac{1}{\left(\lambda\tau Y + T\right)^2}\left\{\left(\lambda\tau\left[I^*\Pi - Y\right] - T\right)dI^* + I^*\left(\tau Y d\lambda + dT\right)\right\},$$

where Π stands for the marginal increase in the local tax base resulting from a marginal increase in the local infrastructure provision and is equal to

$$Y_I - \bar{r}\frac{Y_{KI}}{Y_{KK}}.$$

Substituting from the expression for dI^* from Equation (8) and assuming $\tau Y d\lambda + dT = 0$ results in

$$\left.\frac{d\frac{S^*}{\lambda\tau Y + T}}{d\lambda}\right|_{\tau Y d\lambda + dT = 0} =$$

$$= \frac{1}{\left(\lambda\tau Y + T\right)^2}\left(\lambda\tau\left[I^*\Pi - Y\right] - T\right)\frac{\left|\bar{H}^{44}\right|}{\left|\bar{H}\right|}\frac{v'}{Mc'}\tau\Pi < 0.$$

By analogy we obtain the result for the propensity to subsidize, meas-

ured as a proportion of economic product:

$$\left.\frac{d\frac{S^*}{Y}}{d\lambda}\right|_{\tau Y d\lambda + dT = 0} = \frac{1}{Y^2}\left(I^*\Pi - Y - T\Pi\right)\frac{\left|\bar{H}^{44}\right|}{\left|\bar{H}\right|}\frac{v'}{Mc'}\tau\Pi < 0 .$$

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